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ECOSYSTEM DIVERSITY FRAMEWORK FOR WESTERN MONTANA

Final Report for RJVA# RMRS-99595 Phase II

R. Pfister and M. Sweet

Ecosystem Diversity Framework for Western Montana

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April 6, 2001

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BACKGROUND

Research Joint Venture Agreement # RMRS - 98560 - RJVA Phase I and RJVA # RMRS -99595 Phase II

I. PURPOSE:

A. The overall objective of this agreement is to develop an ecosystem diversity framework for facilitation of ecosystem management planning and implementation. The framework will cover west-central Montana or similar ecological subregion as defined by Region One.

B. Specific objectives are as follows:

1. This research is anticipated to be over a 3-year period with three phases. Future phases will be determined pending anticipated continued funding. Should this research be approved beyond Phase one, an amendment to this agreement shall be prepared for each new phase..

*2. **Phase One** (July 15, 1998 through May 31, 1999)*

a. Develop an ecosystem diversity framework for facilitation of ecosystem management planning and implementation. This framework has to be compatible with current implementation plans for the SIMPPLLE model and Region 1 stand and vegetation classification protocols. The framework will also address standards proposed by the FGDC Vegetation Subcommittee (1997) and ESA Vegetation Classification Panel (1998).

b. Keep Bitterroot Ecosystem Management/Research Project (BEMRP) scientists and managers informed of progress in development of the Diversity Framework through written documents, individual contacts, and special seminars.

*3. **Phase Two** (August 28, 1999 through November 30, 2000)*

a. (1) To revise ecosystem diversity framework components for Western Montana completing documentation of the five component taxonomic protocols. Prepare draft manuscript on the habitat type groups and cover types. Revise existing draft manuscript on size, density, and vertical structure components.

b. (2) To incorporate consideration of continuing revisions of R1 protocols, provide formal input to R1 draft inventory protocols (April 1999), incorporate latest revision of SIMPPLLE| and MAGIS formulations relative to the five components, and document relationships of EDF to draft standards for the National Vegetation Classification System.

c. (3) To develop a demonstration of using EDF for evaluation of owl habitat with Vita Wright.

359. Pfister, R. ; Sweet, M. *Ecosystem diversity framework for western Montana.* 2001: [28] p. [Unpublished Final Report for Research Joint Venture Agreement RMRS-99595 Phase II]

The format of this report is organized on the three objectives (above). Related wo is also reported in a progress report (4-06-01) "Standards and Applications of an Ecosyste Diversity Framework" (a complementary and overlapping RJVA because of extensions on this RJVA). Work on this RJVA was delayed and also deviated from the study plan due to three major factors that are closely related to our objectives: 1) An opportunity to implement the EDF Framework in a major cooperative educational video and training project called "Montana Forests Forever" during the fall of 1999 and spring of 2000; 2) Participation and review of the R-1 Pilot Project to explore synergistic opportunities to implement the EDF concept in their mid-scale vegetation mapping and ground truth efforts; 3) Participation in the continuing dialogue within the ESA Vegetation Classification Panel and with ecologists from the TNC and Heritage Programs in the search for an operational National Vegetation Classification System. A laundry list of activities during the grant period is provided in Appendix A.

Objective a) (1): Revise and write manuscripts on EDF Components

The second draft of the Stand structure manuscript (5/98) includes all of the four existing vegetation components. The recommended classes for Size, Density, and Layering have been generally adopted for the R-1 Protocol work. However, the method of placing plots into those types is far from standard and is being addressed in the "Standards..."RJVA. The density levels specified in the NVCS (25%, 61%) are generally being accepted although it is obvious that a 10 to 25% class and a break of the 25-61 (65)% class is needed for Fores Service applications. Consensus is not evolving on how to standardize Composition. Although FIA will continue to call Cover Type by plurality of basal area as a proven standard for summarizing inventory plot data and develop summary statistics, planners are unable to accept these types for mixed species composition stands and especially for inability to detect the SAF cover types by remote sensing. Therefore, the types defined for GAP by Roly Redmond and the R-1 Pilot Project are using a unique set of Composition types that might be identifiable with more accuracy from remote sensing. (This is also part of Ken Brewers Ph.D. research efforts.) Although it creates an apparently unresolvable dilemma, I believe that it emphasizes that the standard taxonomy for plot and stand type delineations embodied in the EDF is no less viable for summarizing sample inventory data, generating area estimates, and serving as a framework for accumulating knowledge. The final conclusion may be that total integration of a stand taxonomy with a remote sensing mapping effort is not possible. Rather, we must seek methodology that gives reliable area estimates from an objective inventory design and at the same time use the remote sensing to efficiently get wall-to-wall coverage at some specified (lower than desired) accuracy.

A draft manuscript on the habitat type and habitat type group component of the EDF has been prepared and is presented in Appendix B. The initial comparisons reveal more differences then expected and indicate that additional work on this effort is needed before we propose a new "standard" grouping protocol.

Objective b) (2): Incorporate components of evolving R-1 Protocols, SIMPPLLE and MAGIS components and document relationships with evolving standards for the Nat. Veg. Class. System (NVCS)

The evolving R-1 protocols are dovetailing nicely with the EDF for Size, Density, and Layering. As long as the protocols focus on mid-scale mapping, there is little hope of matching a mapping standard with a plot or stand-based taxonomy. Continuing dialogue is critical to help find ways to inventory, plan, and manage by using data for both purposes and documenting relationships that exist between the mapping efforts as opposed to inventory summary methods.

Jim Chew and R-1 colleagues have kept me abreast of evolving classification and data analysis standards. As the EDF classification system reaches a formal draft stage, we will need to document current model relationships with recommended standards in the complementary RJVA.

The standards for the NVCS are evolving very slowly and in a way that appears to have little relationship to the EDF. Recent publications from Heritage Ecologist (Steve Cooper) and the Regional TNC ecologist (Reed) both illustrate that the operational application of Alliance and Association will probably be based on diagnostic species rather than dominant species with keys that only apply to plant community plot data or on-the-ground determinations. If this trend continues, the TNC approach will have minimal value to describe existing vegetation based on dominant vegetation. The ESA Vegetation Classification Panel continues to debate the definition and FGDC use of Alliance and Association. I prepared a Figure (#2) for the ESA standards manuscript to illustrate a wide range of approaches to vegetation taxonomy; I also included my review comments on Draft Version 5.1 and Draft Version 6.0 to illustrate my efforts to bring the NVCS toward and operational vegetation taxonomy (Appendix C). I also analyzed the Montana 1977 h.t. data base and Arno's succession studies for a poster that I converted to manuscript (Appendix D). These data bases may prove useful for additional EDF demos.

Objective c) (3): Demonstration of EDF and Owl Habitat

Mike Sweet has worked with Chris Stalling to obtain coverage of Bitterroot North for an additional demonstration of the EDF and comparison with Stevi-WC. Mike has generated a summary of acreages by EDF component types. However, we have yet to get together on the final product. I also pulled together a package of relevant literature for Mike, Vita Wright and I to review relative to demonstrating owl habitat for Bitterroot North. Vita was very busy with current work assignment and suggested that she didn't have time to work on it but would be willing to review our approximation. This past fall, Jim Chew illustrated potential flammulated owl habitat for Bitterroot North as part of a Fires 2000 Powerpoint presentation. We need to clean up this loose end and document the criteria that Jim Chew used and perhaps independently apply Vita Wrights criteria to try it ourselves. At this point in time, I would prefer to close this RJVA and incorporate that as one of the demonstration areas for the other RJVA on Standards.

Appendix A -- Time Frame -- Activities

The second RJVA (# RMRS-99595) for Phase II was initiated on August 26,1999 and ends February 29, 2000 (Extended to November 30, 2001). (R. D. Pfister retired on 12/31/00 and is now working on a 1/3 time post-retirement contract and volunteering time to complete work on this contract.)

Activities and Work completed to date (Phase I and Phase II):

1. Reviewed Boise-Cascade Ecosystem Diversity Matrix materials (Haufler 96-99)
2. Review of other related efforts in literature.
3. Draft manuscript on standardization of three recommended stand structure variables and obtaining co-author review comments for revision. (97-98)
4. Assembled H.T. Group component protocols from various sources.
5. Assembled Cover Type component protocols from various sources.
6. Presented paper at National SAF in Michigan 10/98. (Pfister and Jones 1999)
7. Reviewed the new "Terrestrial Vegetation of the United States: Volume I--The National Vegetation Classification System: Development, Status, and Applications. Grossman, D. et. al. 10/13/98, The Nature Conservancy. 126 p.
8. Attended the NVCS Standards, ESA Panel Meeting in Tucson, 12/14-16/98.
9. Reviewed the ESA-NVCS standards 12/98 draft manuscript.
10. Presentation--NVCS/Local Class.-- MT Native Plant Society, Pablo (3/25/99).
11. Assembled first draft of Framework for review by collaborators (4/23/99)
12. Conducted two half-day workshops with collaborators (April 99).
13. Documentation of uses of components in Stevi-WC (Pfister & Sweet 1999).
14. Illustrations of Stevi-WC EDF (visualization) (Pfister & Sweet 1999 Poster)
15. Applic. of EDF comp. to new Lubrecht inventory (J. Waterman) (Summer 99)
16. Presentation & Poster at Int. Veg. Class. Workshop, West Glacier (6/30/99)
17. Presentation--EDF & NVCS at Multi-Agency Inv. Workshop, Missoula (7/15/99)
18. Organized Field Trip/Workshop on NVCS for National ESA-Spokane (8/6-7/99)
19. Two Poster Presentations at ESA Spokane. (8/8/99)
20. Attended ESA Panel meeting on NVCS standards in Spokane. (8/9/99)
21. Reviewed ESA August, 1998 draft manuscript on NVCS standards. (Sept.)
22. Phase I contract report (9/9/99)
23. Participated in R-1 Inventory Workshop 9/13-15/99
24. Presentation on H.T. Classification & EDF at Nat. Silv. W. S., Coram (10/5/99)
25. Participated in Landscape Working Group Planning Meetings. (Oct.-Nov.99)
26. Participated in R-1 Inventory Meeting (12/14-15/99)
27. Met with Dave Atkins to review FIA Inventory/EDF summaries. (Dec.99)
28. Continued dialogue with Rene O'Brien (Ogden) on FIA standards. (Dec.99)
29. Met with Ken Brewer on East Side/West Side protocols. (Dec.99)
30. Presentation on EDF and comparison with R-1 (Atkins) analyses of FIA data for Montana using several of variables of EDF at INGY Annual Workshop. (Jan 00)
31. Developed basckground literature package for discussion of a demonstration of EDF for owl habitat with V. Wright. (Jan-Feb.00)

32. Presentation with BEMRP team for R-1 Training Academy (March 23, 2000)
33. Developed text and illustrations for Environment and Management sections of "Montana Forests Forever" educational CD-ROM cooperative project incorporating some basics of EDF(March-June 2000).
34. Completed a CD-ROM on "Montana Forests:Example Images" to illustrate cover types and successional stage components of EDF. (March 2000)
35. Reviewed RMRS-FIA procedures for stand classification of FIA database (March-April 2000).
36. Worked with E. Bella on Lubrecht Veg. Class. Publication (May 00)
37. Participated in discussion of stand data (FIA plots) alternative conversions to vegetation types with R-1 and Carl Fiedler and Chuck Keegan. (Currently have four different rule sets for conversion of tree-list plot data to stand type classification!)
38. Review of proposed DESCRIBE revisions by Chew.
39. Initial analysis of Bitterroot face database (Sweet).
40. Revisions and proofing of Stevi-WC BEMRP 1999 Symposium Paper (Pfister and Sweet 2000)
41. Review of Stand and Site Classification Protocols developed in 1997 to integrate TSMRS and SILC polygons for SIMPPLLE -- Upper Clark Fork version (Chew & Atkins 1997 for inclusion in Phase II documentation. (Currently reviewing proposed revisions of DESCRIBE)
42. Developed first draft manuscript and master list of alternative habitat type groups. (Aug. 00)
43. Dialogue with mensurationists about alternative methods of classifying structural stages from inventory data (Jan - Fall).
44. Continued dialogue on integrating our efforts with those of the TNC and ESA Panel on developing a national protocol that may (or may not) use some of EDF components. (Periodic for past several years.)
45. Participation in all BIRD meetings and BEMRP workshop in Hamilton (fall 00)
46. Review of J. Chew Powerpoint presentation on Fires 2000 including a brief demonstration of location of owl habitat in the Bitterroot North area.

Appendix B (11 pages): Habitat Type Groups: Review and Recommendations

R. D. Pfister (4/6/01)(Rev. 4/26/01)

The first formal forest habitat type taxonomy was developed for the forests of northern Idaho and adjacent Washington by Rexford Daubenmire (1952) and formally revised by R. and J. Daubenmire (1968). The 1968 taxonomy defined 21 habitat types and one additional phase. Foresters began to use the classification for site classification during the 1960's, including attempted extrapolation to adjacent areas.

A formal taxonomy for Montana forests was published in 1977 (Pfister and others 1977). A finer level of stratification and a larger geographic area resulted in a total of 64 habitat types and 35 phases for a total of 99 unique units at the finest level. Although field inventory and mapping were generally carried out to the habitat type and phase level, generalization for management interpretation led to definition of various habitat type groups representing similar environments and, therefore, similar management interpretations. An initial grouping in the Montana publication provided 27 unique groups (*"a grouping made on the basis of overall ecological similarities"*) (Pfister and others 1977, p.141).

The USDA Forest Service 1980 Region One Regional Plan used a formal grouping of habitat types based on "Series" and subdivision of the PSME and ABLA series. Other groupings were developed by individual National Forests for a variety of planning purposes during the 1980's. For example, individual forests developed unique habitat type groups to reflect differences in rates and amounts of hydrologic recovery. Review and comparison of these illustrated major differences across forest boundaries. An attempt was made by the Montana Riparian Association to organize an expert opinion group to develop one standard set of habitat type groups and hydrologic response curves for western Montana. However, the group was unable to carry out a consensus effort for a variety of reasons and some individual National Forests revised their guidelines to correct errors and differences that had been pointed out during the review process.

Formal sets of habitat type groups have been developed and published for several geographic areas in a series of fire ecology publications during the past two decades. The eastern Montana publication (Fischer and Clayton 1983) and western Montana publication (Fischer and Bradley 1987) provide the same master list of habitat type groupings for all of Montana that is used for comparison in this report. *"Habitat types are arranged into 11 "Fire Groups" based on the response of the tree species to fire and roles these tree species take during successional stages"* (Fischer and Bradley 1987, p.1-3).

Fire Group Zero: Miscellaneous special habitats
Fire Group One: Dry limber pine h.t.s.
Fire Group Two: Warm, dry ponderosa pine h.t.s.
Fire Group Three: Warm, moist ponderosa pine h.t.s
Fire Group Four: Warm, dry Douglas-fir h.t.s.
Fire Group Five: Cool, dry Douglas-fir h.t.s.

Fire Group Six: Moist Douglas-fir h.t.s.
Fire Group Seven: Cool h.t.s usually dominated by lodgepole pine.
Fire Group Eight: Dry, lower subalpine h.t.s.
Fire Group Nine: Moist, lower subalpine types
Fire Group Ten: Cold, moist upper subalpine and timberline h.t.s.
Fire Group Eleven: Moist grand fir, western redcedar, and western hemlock h.t.s.

The placement of habitat types and phases into these groups is shown in Appendix B of Fischer and Clayton (1983) and Table 3 of Fischer and Bradley (1987). A comparison of various Fire Groups for different geographic areas has been provided by Smith and Fischer (1997) as their Appendix C.

The old growth management issue prompted the Washington Office of the USDA Forest Service to require Regions to develop a formal classification of old growth stands 1989. A Region One Committee developed a formal old-growth classification that included new habitat type groups (Greene and others 1992). "*Habitat types were grouped using the interdisciplinary process. For each zone a group of ecologists, soil scientists, and silviculturists met and selected criteria for grouping similar habitat types. Criteria used for grouping included: similarity of disturbance response, potential productivity, potential stocking density, potential down wood accumulation, fire frequency, and tree species. These groups relate closely in environment with temperature and moisture regimes" (Green and others 1992, page 3).* Placement of types is documented for three zones in their Appendix A (Northern Idaho, Western Montana, and Eastern Montana). The ones from western Montana are used for this report.

In the early 1990's, some Forest Service silviculturists (J. Chew and Kootenai N. F.) were developing habitat type groups for silvicultural prescriptions. In addition, there was a need for a simplified tool that would provide ecological stratification for private landowners and others not familiar with all the indicator species. A one-page classification simple system based on occurrence of tree species was developed (Pfister, 1991, unpublished) for educational and training purposes (Figure 1).

Groupings have also been made for predicting tree diameter growth rates in the Prognosis (FVS) growth and yield model (Stage 1989). This grouping has a very specific purpose and is based on empirical data. Comparisons with other habitat type groupings would be complicated because Prognosis (FVS) groupings are different for each tree species.

Habitat groupings have also been developed as part of a strategy to predict stand susceptibility for insect or disease agents of disturbance. An example of published groupings for Western Spruce Budworm (Carlson and Wulff, 1989) is provided in table 1 (WSBW) for comparison.

A Forest Service Task Force developed a recent grouping of habitat types for biophysical land classification for planning in 1997 (Northern Region 1997) and is included in table 1 for comparisons. Currently Ken Brewer (Personal Communication) is refining another habitat type grouping as part of his Ph.D. research and work for Region One utilizing remote sensing for land classification and mapping, as shown in Table 1.

Comparison of Alternative Habitat Types Groupings

Recognizing that all classification is purposive, we would expect that each of the habitat type grouping protocols might be unique and ideally suited for a given predictive purpose. On the other hand, for land use planning and many applications it would be desirable to have one general purpose ecologically based standard grouping, rather than independently reinventing a new protocol for each new area or application. Most habitat type grouping protocols provide little documentation on the basis for grouping or lack of discussion of why a previous grouping was replaced or modified. Therefore, a comparison is used to show similarities and differences as the initial basis for proposing a standard grouping.

The documentation for this report was originally developed for Montana (Table 1) and then narrowed to western Montana with fewer groups shown (Table 2). Western Montana includes northwest (NW) and west-central (WC) forest regions as defined by Arno (1980).

Additional forest habitat types for riparian areas in western Montana were described by Hansen and others (1995). These riparian habitat types help incorporate Montana occurrence of northern Idaho habitat types (Cooper and others 1991) and revise a few of the habitat types from Pfister and others (1977). Since most of the grouping efforts have not addressed these types, they will be added later.

Since the Fire Groups (FG) (Fischer and Clayton 1983) and the Old Growth Groups (OG) (Greene and others 1992) are well documented and widely use, the initial comparison and evaluation focused on these two. When looking at distribution of tree species, it is apparent that FG and OG are really quite different (Table 3). The Fire Groups are very narrow and specific for the lower elevation groups and tend to lump more for mid- to higher elevations. The OG groups deviated considerably from Series, creating a wide variety of tree species occurrences and roles within a group – to the point that it is difficult to generalize about tree species occurrences and especially roles at the group level. (Since the WO directions were to develop the OG Guidelines by Cover Types, it is understandable why tree species distributions and roles were not given higher emphasis. That information was already self-evident because old growth criteria were specified primarily by cover types.)

Preliminary evaluation of the OG groups suggests that potential productivity was a stronger driving factor (Table 4), which would relate to the size attained by old trees.

The evaluation suggests that neither FG nor OG groups are ideally suited for silvicultural prescription generalizations. Pfister's (1991) groups or Northern Region (1997) in Table 1 or 2 need to be compared with the OG and FG display in Tables 3 and 4. Further evaluation is planned to provide a solid foundation for any proposed new groupings. This is necessary at this stage because a solid case will need to be built in order to gain interest in yet one more alternative grouping scheme!

GROUP	CLIMATE	TREES PRESENT*	TREES ABSENT*	HABITAT TYPES, PHASES (Pfister, et. al. 1977) Phase: Sci names	PRODUC-TIVITY
1	HOT-DRY OPEN STANDS	PP PP-DF	WL,LPP	PIPO/All PSME/AGSP PSME/FESC	LOW
2	WARM-DRY DF GROUP	DF PP	WL,LPP	PSME/CARU,AGSP, PIPO PSME/PHMA, CARU PSME/SYAL, AGSP (PSME/SYAL, SYAL) (PSME/SYAL, CARU)	LOW to MODERATE
3	MODERATE DF GROUP	DF PP, WL LPP	GF, ES	PSME/CARU, ARUV PSME /LIBO - ALL PSME/PHMA - PHMA PSME/VAGL, ARUV PSME/VACA (PSME/SYAL, SYAL) (PSME/SYAL, CARU)	MODERATE
4	COOL-DRY DF GROUP	DF WL, LPP	PP, AF GF, ES	PSME/CARU, CARU PSME/VAGL, XETE	MODERATE
5	WARM-MOIST GF GROUP	GF PP, DF WL, LPP	AF RC WH	ABGR - ALL	HIGH
6	WARM-MOIST RC&WH GROUP	RC, WH and many others	Few	TSHE-ALL THPL - ALL exc. OPHO	HIGH
7	COOL-MOIST AF GROUP	AF and several others	RC WH	PICEA/CLUN ABLA/CLUN-All ABLA/GATR ABLA/MEFE ABLA/LIBO-All TSME/MEFE	MODERATE to HIGH
8	COOL-DRY AF GROUP	AF and mainly DF, LPP	RC WH PP ES?	PICEA/VACA ABLA/VACA ABLA/XETE ABLA/VASC ABLA/VAGL TSME/XETE ?	MODERATE
9	COLD-MOIST AF GROUP (Upper Subalpine)	AF and several others	WL, DF	ABLA/LUHI-All TSME/LUHI-All LALY-ABLA PIAL-ABLA	LOW
10	WETLANDS	Mainly, ES,LPP RC		PICEA/EQAR THPL/OPHO ABLA/OPHO ABLA/CACA + New 1990 Types	MODERATE to HIGH

*PP= Ponderosa pine, DF= Douglas-fir, WL= Western larch, LPP= Lodgepole pine, GF= Grand fir RC= Western redcedar, WH= Western hemlock, ES= Engelmann spruce, AF= Subalpine fir

Figure 1 – A Sub-Series (H.T. Groups) Classification for Western Montana (R. Pfister 1991)

Table 1 – Master list of habitat type groups for Montana with codes and geographic occurrence (E = western Montana, W = western Montana, EW = both).

Table 1 - Master list of habitat type groups for Montana (E=east, W=West)

DIST	CODE	SERIES	HT	PHASE	MT HT	FIRE	OG	RDP	WSBW	BLM	Stage	R-1	Brewer
					1977	1983	1992	1991		1995		1997	1998
	010	SCREE											
E	000	PIFL			1								
E	040	PIFL	PIFL	AGSP	1	1			7				
E	050	PIFL	FEID		1				7				
E	051	PIFL	FEID	FEID	1	1			7				
E	052	PIFL	FEID	FESC	1	1			7				
E	070	PIFL	JUCO		1	1			7				
	100	PIPO						1					
E	110	PIPO	AND		2	2		1					
EW	130	PIPO	AGSP		2	2	A	1				1	
EW	140	PIPO	FEID		2		A	1				1	
EW	141	PIPO	FEID	FEID	2	2	A	1				1	
E	142	PIPO	FEID	FESC	2		A	1		1			
EW	160	PIPO	PUTR		2	2	A	1				1	
EW	161	PIPO	PUTR	AGSP		2	A	1				1	
EW	162	PIPO	PUTR	FEID		2		1				1	
EW	170	PIPO	SYAL		3		A	1				2	
EW	171	PIPO	SYAL	SYAL	3	2	A	1				2	
E	172	PIPO	SYAL	BERE	3	3		1				2	
E	180	PIPO	PRVI		3			1					
E	181	PIPO	PRVI	PRVI	3	3		1					
E	182	PIPO	PRVI	SHCA	3	3		1					
	200	PSME											
EW	210	PSME	AGSP		4	4		1	7	1		1	
EW	220	PSME	FEID		4	5	A		7	6		1	
EW	230	PSME	FESC		4	4	A	1	7	1		1	
EW	250	PSME	VACA		5	6	B	3	7	3		2	
EW	260	PSME	PHMA		6		B		6	236		2	
EW	261	PSME	PHMA	PHMA		6	B	3	6	3		2	
W	262	PSME	PHMA	CARU		4	B	2	7	26		2	
EW	280	PSME	VAGL		7				6			2	
EW	281	PSME	VAGL	VAGL	7	6	C		6	6		2	
W	282	PSME	VAGL	ARUV	7	6	B	3	6	2		2	
EW	283	PSME	VAGL	XETE	7	6	C	4	6	6		2	
EW	290	PSME	LIBO		7		G	3	6	3		3	
EW	291	PSME	LIBO	SYAL	7	6	G	3	6	3		3	
EW	292	PSME	LIBO	CARU	7	6	C	3	6	36		2	
EW	293	PSME	LIBO	VAGL	7	6	G	3	6	3		3	
EW	310	PSME	SYAL				B		7			2	
EW	311	PSME	SYAL	AGSP	8	4	A	2	7	1		1	
EW	312	PSME	SYAL	CARU	6	6	B	23	7	2		2	
EW	313	PSME	SYAL	SYAL	6	6	B	23	7	2		2	
EW	320	PSME	CARU									2	
W	321	PSME	CARU	AGSP	8	4	A	2		1		1	
EW	322	PSME	CARU	ARUV	5	6	B	3		2		2	
EW	323	PSME	CARU	CARU	9	6	C	4		6		2	
EW	324	PSME	CARU	PIPO	8	4	B	2		2		2	
EW	330	PSME	CAGE		9	5			7	6		2	
EW	340	PSME	SPBE		10	4	B		7	1		2	
E	350	PSME	ARUV		10	4			7	1		2	
E	360	PSME	JUCO		11	6	C		7	6		2	
E	370	PSME	ARCO		11	5	C		7	6		2	
E	380	PSME	SYOR		4	5			7				
	400	PICEA											
EW	410	PICEA	EQAR		16	9	F	10	2	4		8	
EW	420	PICEA	CLUN		12		E	7				7	
W	421	PICEA	CLUN	VACA	12	9						7	
W	422	PICEA	CLUN	CLUN	12	9						7	
E	430	PICEA	PHMA		13	8							
EW	440	PICEA	GATR		13	9	F					8	
EW	450	PICEA	VACA		12	7	H	8	4			9	
E	460	PICEA	SEST		24				4			7	
E	461	PICEA	SEST	PSME		5			4			7	
E	462	PICEA	SEST	PICEA		10			4			7	
EW	470	PICEA	LIBO		13	7						7	
EW	480	PICEA	SMST		13	8	F		6			8	
	500	ABGR			14			5					
	501	THPL						6					
	502	TSHE						6	3				
W	510	ABGR	XETE		14	11	C	5	6			3	AG2

W	520	ABGR	CLUN		14		D	5	5			4	AG2
W	521	ABGR	CLUN	CLUN	14	11	D	5	5			4	AG2
W	522	ABGR	CLUN	ARNU	14	11	D	5	5			4	AG2
W	523	ABGR	CLUN	XETE	14	11	D	5	5			3	AG2
W	530	THPL	CLUN		15		D	6	3			5	TP
W	531	THPL	CLUN	CLUN	15	11	D	6				5	TP
W	532	THPL	CLUN	ARNU	15	11	D	6				5	TP
W	533	THPL	CLUN	MEFE	15	11	D	6				5	TP
W	550	THPL	OPHO		16	11	F	10	3			6	TP
W	570	TSHE	CLUN		15		D	6	3			5	TH
W	571	TSHE	CLUN	CLUN	15	11	D	6	3			5	TH
W	572	TSHE	CLUN	ARNU	15	11	D	6	3			5	TH
W	590	ABGR	LIBO		14		G	5				3	AG2
W	591	ABGR	LIBO	LIBO	14	11	G	5	5			3	AG2
W	592	ABGR	LIBO	XETE	14	11	G	5	5			3	AG2
	600	ABLA											
W	610	ABLA	OPHO		16	9	F	10	3			8	
EW	620	ABLA	CLUN				E	7	5			7	AL1
EW	621	ABLA	CLUN	CLUN	17	9	E	7	5	5		7	AL1
EW	622	ABLA	CLUN	ARNU	17	9	E	7	5	5		7	AL1
W	623	ABLA	CLUN	VACA	17	9	E	7	5	5		7	AL1
EW	624	ABLA	CLUN	XETE	17	9	E	7	5	5		7	AL1
EW	625	ABLA	CLUN	MEFE	17	9	E	7	5	5		7	AL1
EW	630	ABLA	GATR		17	9	F	7	5	4		8	AL2
EW	640	ABLA	VACA		18	7	H	8	4	7			AL2
EW	650	ABLA	CACA		19		F	10	2	4			AL2
EW	651	ABLA	CACA	CACA		9	F		2	4			AL2
EW	653	ABLA	CACA	GATR		9	F		2	4			AL2
EW	654	ABLA	CACA	VACA		7	F		2	4			AL2
EW	660	ABLA	LIBO		17	9	E	7	5	5		7	AL2
EW	661	ABLA	LIBO	LIBO	17	9	E	7	5	5		7	AL2
W	662	ABLA	LIBO	XETE	17	9	E	7	5	5		7	AL2
EW	663	ABLA	LIBO	VASC	17	7	H	7	5	7		9	AL2
EW	670	ABLA	MEFE		20	9	E	7	2	457		7	AL1
W	680	TSME	MEFE		20	9	E	7	1			7	TM
EW	690	ABLA	XETE				H	8	4	7		9	AL3
EW	691	ABLA	XETE	VAGL	21	8	H		4	7		9	AL3
EW	692	ABLA	XETE	VASC	22	7	H		4	7		9	AL3
	700	Lower su											
W	710	TSME	XETE		21	8	H	8	1			9	TM
E	720	ABLA	VAGL		21			8	4	7		9	AL3
EW	730	ABLA	VASC		22		I	8		7		9	AL3
E	731	ABLA	VASC	CARU			H					9	AL3
EW	732	ABLA	VASC	VASC		7	I					9	AL3
E	733	ABLA	VASC	THOC		8						7	AL3
EW	740	ABLA	ALSI		20	9			2	7		7	AL1
E	750	ABLA	CARU		23	8	C		6			9	AL3
E	770	ABLA	CLPS		24	8			6				AL3
E	780	ABLA	ARCO		23	8			4			9	AL3
E	790	ABLA	CAGE									9	AL3
E	791	ABLA	CAGE	CAGE	22	7			4			9	AL3
E	792	ABLA	CAGE	PSME	23	8			4			9	AL3
	800	Upper su											
E	810	ABLA	RIMO						1				
EW	820	ABLA-PIA	VASC			10	I		1			10	AL4
EW	830	ABLA	LUHI		25		I	9	1			10	AL4
EW	831	ABLA	LUHI	VASC	25	10	I	9	1			10	AL4
EW	832	ABLA	LUHI	MEFE	25	10	E	9	1			7	AL4
W	840	TSME	LUHI		25			9	1			10	TM
W	841	TSME	LUHI	VASC	25	10		9	1			10	TM
W	842	TSME	LUHI	MEFE	25	10		9	1			10	TM
EW	850	PIAL-ABL			26	10	J	9	1			11	PA
EW	860	LALY-ABL			26	10	J	9	1			11	LL
EW	870	PIAL			26	10	J		1			11	PA
	890	Timberli											
	900	PICO			27								PC
E	910	PICO	PUTR		27	7						9	PC
E	920	PICO	VACA		27	7	H					9	PC
EW	930	PICO	LIBO		27	7	H					9	PC
EW	940	PICO	VASC		27	7	H					10	PC
E	950	PICO	CARU		27	7						9	PC

Table 2. Abbreviated list of H. T. Groups for western Montana.

Table 2 - Reduced master list of habitat type groups for western Montana (E=east, W=West)

DIST.	CODE	SERIES	HT	PHASE	MT HT	FIRE	OG	RDP
					1977	1983	1992	1991
EW	010	SCREE						
W	100	PIPO						1
EW	130	PIPO	AGSP		2	2	A	1
EW	140	PIPO	FEID		2		A	1
EW	141	PIPO	FEID	FEID	2	2	A	1
EW	160	PIPO	PUTR		2	2	A	1
EW	161	PIPO	PUTR	AGSP		2	A	1
EW	162	PIPO	PUTR	FEID		2		1
EW	170	PIPO	SYAL		3		A	1
EW	171	PIPO	SYAL	SYAL	3	2	A	1
EW	200	PSME						
EW	210	PSME	AGSP		4	4		1
EW	220	PSME	FEID		4	5	A	
EW	230	PSME	FESC		4	4	A	1
EW	250	PSME	VACA		5	6	B	3
EW	260	PSME	PHMA		6		B	
EW	261	PSME	PHMA	PHMA		6	B	3
W	262	PSME	PHMA	CARU		4	B	2
EW	280	PSME	VAGL		7			
EW	281	PSME	VAGL	VAGL	7	6	C	
W	282	PSME	VAGL	ARUV	7	6	B	3
EW	283	PSME	VAGL	XETE	7	6	C	4
EW	290	PSME	LIBO		7		G	3
EW	291	PSME	LIBO	SYAL	7	6	G	3
EW	292	PSME	LIBO	CARU	7	6	C	3
EW	293	PSME	LIBO	VAGL	7	6	G	3
EW	310	PSME	SYAL				B	
EW	311	PSME	SYAL	AGSP	8	4	A	2
EW	312	PSME	SYAL	CARU	6	6	B	23
EW	313	PSME	SYAL	SYAL	6	6	B	23
EW	320	PSME	CARU					
W	321	PSME	CARU	AGSP	8	4	A	2
EW	322	PSME	CARU	ARUV	5	6	B	3
EW	323	PSME	CARU	CARU	9	6	C	4
EW	324	PSME	CARU	PIPO	8	4	B	2
EW	330	PSME	CAGE		9	5		
EW	340	PSME	SPBE		10	4	B	
EW	400	PICEA						
EW	410	PICEA	EQAR		16	9	F	10
EW	420	PICEA	CLUN		12		E	7
W	421	PICEA	CLUN	VACA	12	9		
W	422	PICEA	CLUN	CLUN	12	9		
EW	440	PICEA	GATR		13	9	F	
EW	450	PICEA	VACA		12	7	H	8
EW	470	PICEA	LIBO		13	7		
EW	480	PICEA	SMST		13	8	F	
W	500	ABGR			14			5
W	501	THPL						6
W	502	TSHE						6
W	510	ABGR	XETE		14	11	C	5
W	520	ABGR	CLUN		14		D	5
W	521	ABGR	CLUN	CLUN	14	11	D	5
W	522	ABGR	CLUN	ARNU	14	11	D	5
W	523	ABGR	CLUN	XETE	14	11	D	5

Table 3 – Tree species distribution by Old Growth Groups and Fire Groups for Western Montana.

Table 3 - Tree species distribution by Old Growth Groups and Fire Groups for Western Montana.

OG GROUPS (1992)	PP	DF	WL	LPP	GF	WRC	WH	PIC	WP	AF	MH	WBP	AL
A - Warm & Dry	C	(C)											
(Open PP-DF)													
B - Mod. Warm & Dry	S	C	S	S	(C)					(C)			
(PSME-mod - ++)													
C- PSME-cool	(S)	C	S	S	(C)					(C)			
Mod. Cool & Dry													
D - Warm & Moist	(S)	S	S	S	(C)	(C)	(C)	S	(S)				
(GF-WRC-WH)													
E - Cool & Moist		S	(S)	S				(C)	(S)		(C)		
(ABLA moist ++)								(C)		(C)	(C)		
F - Wet				(S)		(C)	(C)	(C)		(C)			
(EQAR, OPHO, CACA)													
G - Mod. Cool & Moist	(S)	(C)	(S)	(S)	(C)								
(DF & GF/ LIBO													
H - Cool & Mod. Dry		S	(S)	S				(C)		(C)	(S)		
(AF/VACA, XETE ++)													
I - Cold and Mod. Dry										C		(S)	
(VASC, LUHI)													
J - Cold										(C)		(C)	(C)
(Timberline)													
FIRE GROUPS (1983)	PP	DF	WL	LPP	GF	WRC	WH	PIC	WP	AF	MH	WBP	AL
0 - Miscellaneous													
1 - Dry Limber Pine													
2 - Warm, dry PP	C												
3 - Warm, moist PP	C												
4 - Warm, dry DF	S	C											
5 - Cool, dry DF		C	S	S									
6 - Moist DF	S	C	S	S									
7 - Cool – LPP		(C)	(S)	S				(C)		(C)			
8 - Dry, lower subalp		S		S				(C)		(C)	(C)		
9 - Moist lower suba		(S)	(S)	S				(C)	(S)	(C)	(C)		
10- Cold, moist, upper				(S)				(C)		(C)	(C)	(C)	
11 - Moist GF, WRC, WH	(S)	(S)	(S)	(S)	(C)	(C)	(C)	(C)	(S)				

Table 4 - Potential Productivity by Old Growth Groups and Fire Groups for Western Montana.
(Yield Capability = MAI@Culm in Cu. Ft./A/Yr.)

OG GROUPS (1992)	Very Low	Low	Moderate	High	Mean	Class
A - Warm & Dry	19	21,23,27	52,59,66		36	Low
(Open PP-DF)		28,36,42				
B - Mod. Warm & Dry			52,59,66,67		66	Mod.
(PSME-mod - ++)			70,74,75			
C- PSME-cool			52,59,67,79		64	Mod.
Mod. Cool & Dry						
D - Warm & Moist				104,108,111	108	High
(GF-WRC-WH)						
E - Cool & Moist		33	72,81	92,92	74	Mod.
(ABLA moist ++)						
F - Wet			62,63,66,78,83	88	73	Mod.
(EQAR, OPHO, CACA)						
G - Mod. Cool & Moist			67	106	86	High
(DF & GF/ LIBO						
H - Cool & Mod. Dry			58,64,72	95	72	Mod.
(AF/VACA, XETE ++)						
I - Cold and Mod. Dry		33	64		48	Low
(VASC, LUHI)						
J - Cold	11				11	V. Low
(Timberline)						
FIRE GROUPS (1983)	Very Low	Low	Moderate	High	Mean	Class
0 - Miscellaneous						
1 - Dry Limber Pine						
2 - Warm, dry PP	19	23,36,42			30	Mod.
3 - Warm, moist PP						
4 - Warm, dry DF		21,28	59,66,70,74		53	Mod.
5 - Cool, dry DF		27,40			34	Low
6 - Moist DF			52,59,66,67,70,75		65	Mod.
7 - Cool -- LPP			58,64,68,72	95	71	Mod.
8 - Dry, lower subalp			62,64		63	Mod.
9 - Moist lower suba			63,66,72,76,81,83	88,92,92	79	Mod.
10- Cold, moist, upper	11	33			22	Low
11 - Moist GF, WRC, WH			79	104,106,108,111	102	High
(HTG T4.xls)						

Recommendations

Preamble: A strong recommendation (requirement) for a single standard of grouping habitat types is a strong temptation for administrators desiring simple uniformity. On the other hand, scientists studying variation among different groups are encouraged to use the classification at the finest level and do the grouping after relationships have been established through analysis and interpretation of the data. Expert opinion approaches to summarize existing knowledge as operational guidelines are caught in the middle. They need to start from a classification system and use grouping appropriate to the question or problem at hand.

Recommendations:

1. Two formal habitat type grouping approaches are well documented and are used widely (Fischer and Clayton 1983, and Green and others 1992). Therefore, it is appropriate to continue using them if they meet current application needs or start from these as a foundation for any new proposed standard. Comparison of these two illustrate that with moderate revisions they might be combined into a new single grouping with appropriate justification.

2. Any new habitat type groupings should document why the two listed above are not appropriate for their specific purposes. Furthermore, a table should be provided that shows how they compare with the published FG and OG groups.

3. Be wary of summarizing inventory, research data, or expert opinion summaries of knowledge at the h.t. Group level without providing documentation of how that knowledge was obtained by grouping upward from the lowest possible level in the habitat type taxonomy. Since the process of generalizing to a higher level of the hierarchy usually involves analysis of information from lower levels, it is extremely important to document the linkage so that further refinement is possible.

4. Collect and maintain data at habitat type and phase level to maintain integrity and flexibility to take advantage of using alternative groupings.

5. Continue work on review, comparison and documentation as foundation for publishable manuscript on the subject of habitat types groups.

References

Arno, S. F. 1980. Forest Regions of Montana. Res. Pap. INT-218, Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 39 p.

Carlson, C. E. and N.W. Wulf. 1989. Silvicultural stratagies to decrease stand and forest susceptibility to the western spruce budworm. Agric. Handb. No. 676. Washington, DC: USDA, Forest Service, Cooperative State Research Service. 31 p.

Cooper, S. V., K. E. Neiman, R. E. Steele, D. W. Roberts. 1991 Forest habitat types of northern Idaho: a second approximation. Gen. Tech . Rep. INT-236. Ogden, UT: USDA, Forest Service, Intermountain Research Station. 135 p.

Daubenmire, R. 1952. Forest vegetation of northern Idaho and adjacent Washington, and its bearing on concepts of vegetation classification. Ecological Monographs. 22:301-330

Daubenmire R and J. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Tech. Bull. 60 Pullman, WA:Wash. Agric. Exp. Sta. 77 p.

Fischer, W. C. and B. D. Clayton. 1983. Fire ecology of Montana forest habitat types east of the Continental Divide. Gen. Tech. Rep. INT-41. Ogden, UT: USDA, Forest Service, Intermountain Research Station. 83 p.

Fischer, W.C. and A.F. Bradley. 1987. Fire ecology of western Montana forest habitat types. General Technical Report INT-223, Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 95 p.

Green, P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann. 1992. Old-Growth Forest Types of the Northern Region. R-1 SES 4/92; USDA Forest Service, Northern Region, Missoula, MT 59807. 60 p.

Hansen, P. L., R. D. Pfister, K. Boggs, B. J. Cook, J. Joy, and D. K. Hinckley. 1995. Classification and Management of Montana's Riparian and Wetland Sites. Montana For. And Cons. Exp. Sta., School of Forestry, The University of Montana, Missoula, MT. Misc. Publ. No. 54. 646 p.

Northern Region. 1997. Habitat Type Group Classification for Westside Forests (Lower Clark Fork Zone). Biophysical Classification, Habitat Groups and Descriptions, Finalized May 1997. USDA, Forest Service, Northern Region, Missoula, MT. 17 p. (V. Applegate, D. Atkins, G. Ford, D. Berglund, J. Johnson, L. Kuennen, D. Leavell, D. Sirucek, B. Wulf, A. Zack)

Pfister , R. D., B. L. Kovalchik, S. F. Arno, and R. D. Presby. 1977. Forest habitat types of Montana. Gen. Tech. Rep. INT-34. Ogden, UT: USDA, Forest Service, intermountain Forest and Range Experiment Station. 174 p.

Smith, J. K. and W. C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. Gen. Tech. Rep. INT-GTR-363. Ogden, UT: USDA, Forest Service, Intermountain Research Station. 142 p.

Stage, A. R. 1989. Utility of vegetation-based land classes for predicting forest regeneration and growth. In: Ferguson, D. E., P. Morgan, F. D. Johnson (compilers) 1989. Proceedings – land classifications based on vegetation: applications for resource management. 1987 Nov. 17-19, Moscow, ID. Gen. Tech. Rep. INT-257. Ogden, UT:USDA, Forest Service, Intermountain Research Station. 315 p.

Appendix C (8 pages): -- Vegetation Terminology developed by R. Pfister as Figure 2 for ESA Vegetation Standards Manuscript Version 5.1 (1999) and Version 6.0 (2000). (Review/revision comments on Versions 5.1 and 6.0 on following seven pages)

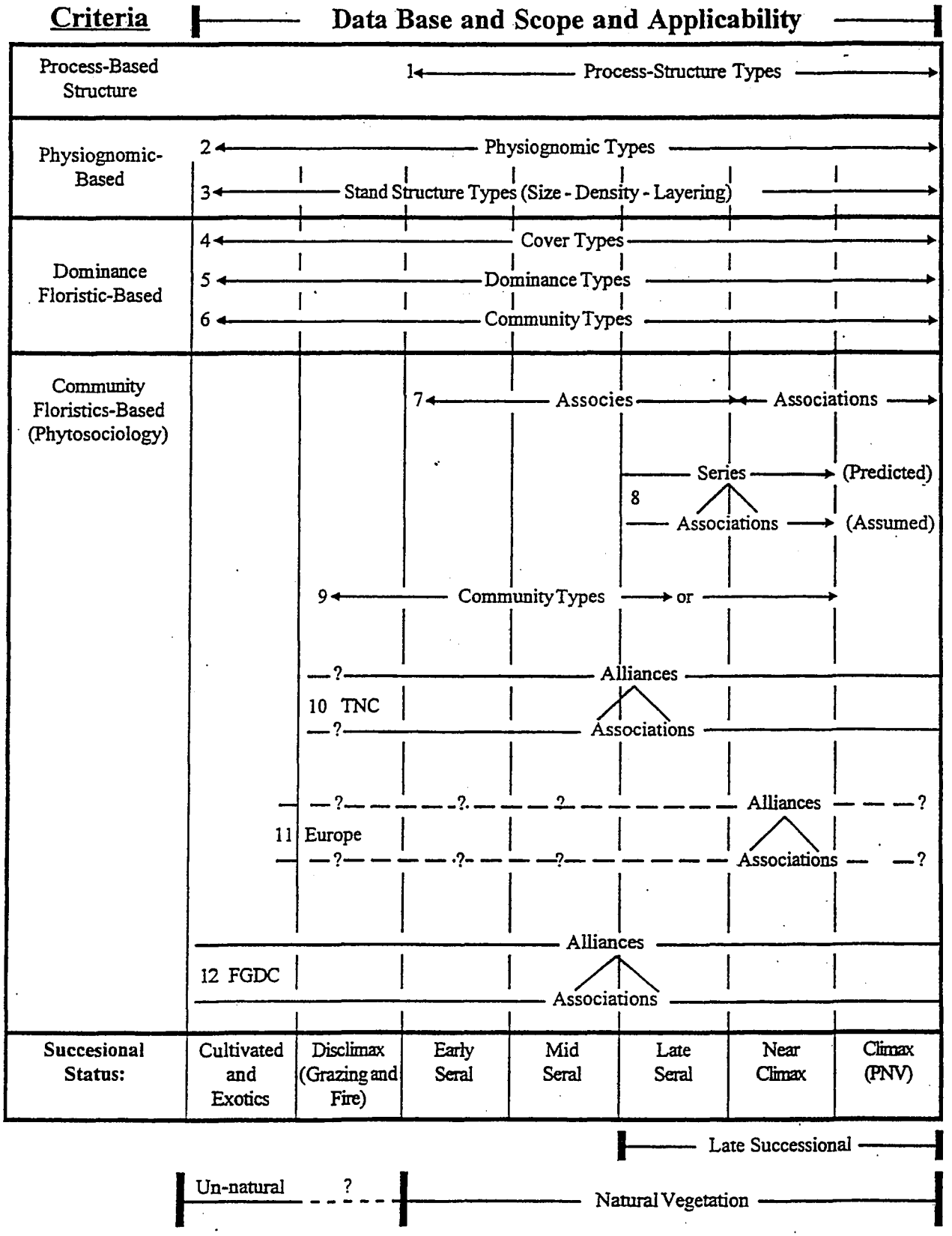

FIGURE 2. Vegetation taxonomy terminology in relation to successional status and naturalness of vegetation.

9-15-99

To: Lori Hidinger, ESA Panel
From: Bob Pfister, Panel Member
Subject: Review Comments on Review Draft V. 5.1

PREFACE: My compliments to the rewrite team. It is extremely difficult to establish concrete standards at this stage of development of the concept and vision of the NVCS. It became obvious at the West Glacier Symposium (6/99) and the Spokane ESA Workshop (8/99) that many vegetation scientists are ready and willing to contribute to the NVCS if clear directions can be provided for defining new taxonomic units and recognizing (identifying) established taxonomic units. Whatever we specify as standards will undoubtedly reveal some major interface problems with associations currently defined in the literature. I shared some of these frustrations and recommendations for the NVCS in a poster session at West Glacier and at Spokane. For those that did not read the poster, I am attaching the text to my review comments. Re-analysis of existing data bases will obviously be needed to implement standards as they are refined beyond current ambiguity.

EDITORIAL COMMENTS:

1.3.2 *"Panel adopts and recommends continued use of the definitions and concepts used by the FGDC (1997) for association and alliances."* -- Comment – the broad definitions used to obtain origiinal consensus do not lend themselves to development of explicit standards—standards will help clarify current ambiguity and should logically lead to future improved definitions. The current statement implies the definitions aid understanding. We have all witnessed the confusion that exists in trying to understand or explain the intended meaning of "alliance" and "association" as operational taxonomic entities.

(The FGDC 1997 NVCS makes provision for improvement and revision—Why does the ESA want to avoid the idea that our panel of scientists might come up with recommended revisions of FGDC 1997?

1.3.3 *"NVC guiding principles have been assumed in developing the standards"* -- (The FGDC 1997 NVCS makes provision for improvement and revision—Why does the ESA want to avoid the idea that our panel of scientists might come up with recommended revisions of FGDC 1997? -- I think principle #9 and principle #11 are illogical and unnecessary as currently stated. Most ecologists agree that physiognomic and floristic taxonomies are useful and valuable in their own right. Merging the two in a single hierarchy was proposed by Driscoll et. al (1983 and 1984) in their publication, but, to my knowledge, was never formally implemented by the partner agencies! It was patently rejected by Braun-Blanquet and Z-M followers. (The simple solution is to recommend disconnection of the nested hierarchy and use both classifiations for all plots and polygons. This will allow analysis of data to demonstrate the true problems of lack of 1:1 correlation of floristic units vs. physiognomic units.)

1.3.4 # 2 -- I do not believe that provisional "associations" and "alliances" should be listed in a NVCS. This defeats the whole concept of "standards" and creates more confusion than necessary. (Provisional units do not deserve the formal title until they meet the criteria. You can still list them locally as "local community types", but don't mess up the standard NVCS with undocumented guesses!

#7 – Suggest substitution of "syntaxonomic units" for "classification's taxonomy and named units"

#8 – Suggest substitution of "relate only to defining syntaxonomic units" for "relate to classification".

- Please avoid jargon of "habitat or alpha level" (use same terminology as p.4 (individual plant community, stand, or landscape patch)
- -- suggest using 1975 Soil Taxonomy rather than 1951 reference for SCS National Soil Classification System.
- NOTE: The assumption made here narrows our efforts to a small portion of FGDC Veg. Sub C. needs that will standardize ground-level, bottom-up system based on criteria not detectable by remote sensing. The driving force for FGDC was standardization of map units—in contrast our energies have been totally dedicated to writing standards for taxonomic units at the plot level that will not be mapped for extensive areas in the foreseeable future because diagnostic species are not detectable by remote sensing.

1.4 -- 1.3 – suggest substituting "explicit" for "established readily applicable"

1.4 – para. 4 –suggest substituting "defining for "identifying" (Types are defined by author as contribution to formal taxonomy. Users of the taxonomy identify placement of new object (plot or stand) within the appropriate taxon (if previously defined).

2.1.3 References to Figure 2 – No. 6 should be No. 4 ; No. 7 should be No. 5, No. 8 should be No. 6
2.1.4 P. 11, Line 2,Reference to Figure 2 – No. 9 should be No. 11
P. ll line 18 insert "(Figure 2, No. 7)" after the word "composition".
P. 11, line 29-31. Rewrite sentence keeping focus on "associations" of both approaches and don't even mention habitat types because that is covered later. Suggested replacement: "A fundamental difference from the Braun-Blanquet approach is apparent in forest vegetation where the Daubenmire approach assigns primary weithting to diagnostic members of the predominant life forme (tree species) and only secondary weghting to diagnostic members of the undergrowth vegetatation. Another difference is the the Daubenmire approach makes an explicit effort to interpret "climax" vegetation from the late-successional natural vegetation database".
P. 11, line 36 Fig 2, No. 13 should be No. 8.
P. 13 line 5 , Insert (Figure 2, No. 9) after "disclimax plant communities)
2.1.7 page 14, Lines 2 through 7 should probably be removed because they are speculative, theoretical, and argumentative. E.g. – show me a single landscape where the PNV map and existing vegetation type map are identical and the statement might be worth making! Also, potential vegetation is usually determined by samples of latest successional vegetation available and projection based on knowledge of species autecology and competitive succession—not by suites of site factors!!!!! The best predictions of future vegetation are made from interpretation of existing conditions and knowledge of species, not by indirect site factor approaches.
2.1.7 p. 14, lines 8-11. Revise to remove the controversial word "alliance". Suggest " The complementary nature of the two approaches can be illustrated routinely by assigning each classification to all stands and map units. Maps of existing vegetation types and potential vegetation types, arranged side-by-side or as overlays are powerful demonstration tools of the relationship of existing conditions to potential future conditions if left undisturbed."
4.1, p. 27 – The "association" and "alliance" are the focus of the standards, BUT forcing them into the cubbyholes of the physiognomic classification means that the NVCS associations and alliances will be DIFFERENT FROM "associations" and "alliances" throughout most other approaches that do not nest them under a physiognomic taxonomy. Therefore, physiognomic type controls context!
4.1.1 –*"The association is the fundamental unit of vegetation in the NVC"* – What??, The association is the lowest taxonomic level recognized in the NVC. **We have already stated elsewhere in the document that the stand (or landscape patch) and the releve' are the fundamental units of vegetation!** Secondly, please insert "[type]" after "plant community" to provide the appropriate translational context for the 1910 dialogue in German, French, and English. Insert "general" between "this" and "concept"—because a wide variety of specific applications have evolved.
4.1.1, page 29 – After a detailed and good discussion of the complexities of analyzing data to develop formal associations, this section needs to end on line 5! The however....sentence at end of paragraph is gobbledy-gook. Subjective judgement and quantitative methods are (should be) complementary! The last paragraph in the section could be on the importance of subjective judgement, intuition, knowledge of vegetation, autecology, and environments, etc.
4.1.1 p. 29, lines 12-15 – These sentences need to be deleted because they contradict everything said earlier about standards! Diagnostic species cannot be determined in the absence of complete floristic data sets! "Available information on diagnostic species and environmental variables" sounds like wishful thinking by someone who has never defined an association!
4.1.2 *Alliance* – **This section is so ambiguous that it screams "there is no standard" Multiple choice question:**

A) – an aggregation of associations based on diagnostic species in common (Braun-Blanquet rules state that you can't have an Alliance until Associations are defined.)
B) – a cover type or dominance type
C) -- a cover type dominant in combination with a diagnostic species
D) – all of the above

I suspect that the reason we are having so many questions about this is because different protocols are obvious within Volume II of the TNC NVCS (Grossman 1998). The literature reviewed to develop Volume II included the full variety of different ways to recognize a level above association in the hierarchy.
The current writeup on Alliance (4.1.2) belongs in the TNC publication (Grossman 1998). Then the defensive stance in support of TNC development to date is appropriate. It is not our problem if want to

serve as an independent, objective panel of professional scientists. We have the professional responsibility and the scientific freedom to recommend improvements in FGDC (1997) and TNC (1998)

The ESA Panel needs to make it's own recommendation to FGDC on what the Alliance standard should be. If there is no consensus—why not simply recommend that Alliance should be removed from the NVCS National Hierarchy until such time as enough associations are defined to establish Alliances . Since we have now formally documented that our concept of "Alliance" is distinct from Z-M, then it seems even more appropriate for our panel to recommend to FGDC that "Alliance" be dropped.

4.2 – I do not agree with requiring nesting under physiognomic hierarchy.

4.3 – p. 33-34 -- The Alliance concept of the FGDC appeared to be an operational level that most professionals could relate to. However, "diagnostic species primarily in dominant stratum", "some cases secondary stratum", data rich, data poor, "differs from European", no single right or wrong procedure" ----- **"where is the standard"? We do not have one and we haven't recommended one! Or do we simply adopt the TNC List?**

6.0 to 6.5 Good Sections to lay out future challenges.

CONCLUSIONS and RECOMMENDATIONS

1. Admit that most of the Alliances formally recognized to date (by TNC) are either simple Dominance Types or Dominance Subtypes (split with diagnostic second species) or Diagnostic Series as a First Approximation. (Volume II of TNC is our only source document and most of the Panel probably has not studied it or reviewed it or how the associations were grouped into alliances.)
2. Admit that we would like a standard for alliance similar to Z-M but lack adequate data to define associations.
3. Recommend to FGDC that "Dominance Type" should be the operational minimum standard for mapping and inventory until Alliances are further developed.
4. Recommend to FGDC that they disconnect the formal nested physiognomic hierarchy from Dominance types and a floristic hierarchy.

From: Lori Hidinger [lori@esa.org]
Sent: Friday, July 14, 2000 7:30 AM
ghartsho@acpub.duke.edu; shaw.denice@epamail.epa.gov; rpfister@forestry.umt.edu; mbuford/wo@fs.fed.us; stephen_talbot@fws.gov; jennings@geog.ucsb.edu; debrown@imap3.asu.edu; adamman@ksu.edu; mwalker@lter.uaf.edu; LOUCKSOL@MUOhio.edu; gary_waggoner@nbs.gov; kspaeth@nwrc.ars.pn.usbr.gov; agl@psu.edu; joanw@rrdi.frr.clemson.edu; dgrossman@tnc.org; dglennle@twsuvm.uc.twsu.edu; mgbarbour@ucdavis.edu; robert_peet@unc.edu
Cc: scido@cc.usu.edu
Subject: Revisions to Draft "Initiative"

v60july00.doc

TO: ESA Panel on Vegetation Classification
FROM: David Glenn-Lewin

Attached is <v60july00.doc> a WORD file with the latest version, 6.0, of our floristic classification document.

To start, I had more or less detailed comments from 10 people, not all of whom were panel members. I read and considered every comment or suggested change, incorporating many, or making another change prompted by the comment. The one group of comments I did not incorporate was the opinion of some (a minority, but definitely more than one), that the floristic levels not be nested within the physiognomic ones. In some ways, I personally agree with them, but we have assumed the nesting will be the case, in part because of the FGDC principles. However, this did prompt me to rethink how we stated the rationale, and the basis for the hybrid system, and I think it reads more completely and logically now.

There are many, many changes, too many to identify, so let be try to give you an overall picture. The document is [illegible]ficantly shorter. I have rewritten every chapter, rearranged material, eliminated words, sentences, paragraphs, [illegible]s; written some new items, modifed word choice, puctuation, etc., etc. My goals were three: to make it read logically [illegible]igh topics (and as parallel from chapter to chapter as possible), to simplify sentences and replace passive with active voice, at least in some places, and to pare it to standards and principles. I doubt that I have succeeded everywhere, but nevertheless, the document is much modifed.

I rearranged and shortened Chapter 1, to make it a direct statement of goals and background principles, leading to our choices. It has fewer sections, as do some of the other chapters.

Chapter 2 has been much redone, to point history, again, toward the decisions we have made.

Chapter 3 was still pretty rough, and difficult to follow. I did much rewriting here. I also was more prescriptive in some cases, e.g., stating specifically the break points on a cover scale, stating specifically which strata to record, etc. To some degree, I also did this in Chapter 4. The panel may not like the choices I made, but I think it wil be easier for the panel to debate the topic from a specific starting point, than to range through all possibilties first. I eliminated Table 4 (and renumbered 5 and 6 as 4 and 5); this was the panel concensus at our last meeting.

Chapter 4 was simplified, and much rearranged. I got rid of a lot of advice and details. The most important item still to be developed here are the rules for association and alliance nomenclature (Sec. 4.5.2). There is a short paragraph on it, but I did not have time to develop a more specific statement of naming rules. The panel should address this directly.

Chapter 5 is about 4 pages instead of 12 or so. What remains also is much rearranged. I took out all the details of architecture, etc., and included only data flow, management, and the requirements that any NVC data base structure must meet. I also eliminated Appendix 4, as detail rather than standards.

Chpater 6 also is shorter, and much rewritten.

[illegible] I did not do:

[illegible]ot vet the Lit. Cited against the text. That needs to be done.

I did not vet the text against Tables 1, 2, or 3, or against the appendices. This needs to be done, and the tables and appendices modified, if necessary. E.g., in the sampling chapter, I stated some specific items, but have not checked to see if the related table or appendix is in agreement.

I did not expand on legacy data (Sec. 3.2.6). I do not recall clear guidelines from our discussions. It should not be difficult to flesh this out.

Denny, I dropped the reference to the TNC cover scale in Chapter 3. Your comments stated that you had a new one, but I did not have any details. That bit should be modified to include your new scale.

Finally, I have not separated out "standards" like we had discussed previously. In the first place, the rewrite, I think, is much more direct, and I am not sure if this is needed any more. Secondly, this is a task do to lastly, after all the standards have been set.

One other item I should mention:

I dropped the reference to "ancillary" plots in Chapter 3. This got to be so unwieldy, and it became evident to me that there really is no such thing. This is a big change. As I stated in my previous note, I did not vet the tables or appendices against the text, and as I was cleaning up, I noticed "ancillary" in tables 1 and 2. All that, in the heading and the table column, should come out.

Have a go at it. Hope it has moved us forward.

dgl

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Date: 9/29/00
To : Lori Hidinger
From: Bob Pfister
Subject: Version 6.0 Comments

I think our Panel owes David Glenn-Lewin a major thank-you for his herculean effort to completely rework the manuscript in a sincere effort to bring this process to a logical, visible benchmark of accomplishment. I was curious to see the collection of review comments which were not shared with the panel. However, I am satisfied that David was in the unique position to provide an objective overview. I also appreciate the explanation he provided to Panel by e-mail.

Overall: This document needs to move rapidly forward through a formal peer review and publication process! "Review Draft v.6.0 July 2000 (DO NOT CITE)" should not proceed indefinitely to v7.0, v8.0, etc. --finish this immediate task and move forward to the needed implementation. Numerous scientists need to be able to cite this document in their current vegetation classification publications. If we do not put it in the accessible literature for application, demonstration, testing, etc., we are actually slowing down progress toward the shared goal of a future operational NVC! By cleaning up the items mentioned by David and incorporating the review comments on Version 6.0, we should publish sooner rather than later!

Specific Comments:

2.1.2 --lines 1-6. Problem -- untrue or unclear statement --*"This was an awkward combination,however, as one applies to existing vegetation, but the other to late-successional vegetation."* (I have not read Dick-Peddie 1993 but I am totally familiar with Driscoll et. al. (1984))
We have already stated in paragraph 2 of page 9 that UNESCO was based primarily on climax or potential natural vegetation and it should be clear that the Daubenmire Association and Habitat Types are also reflecting climax or potential vegetation (using data from "late-successional stands). How can we say that, "one applies to existing vegetation but the other to late-successional vegetation." If Dick-Peddie did not understand that, then remove the reference and the entire offending sentence! Also revise the last part of the first sentence to read, *"vegetation-based site classification component for an ecological land classification system."*

Insert a New Transitional Statement between the Driscoll, et. al. Approach and TNC to document where the real confusion has arisen: *"An obviously similar physiognomic-floristic hierarchy was adopted for the TNC (Grossman et. al. 1988) for their classification protocol. However, in this case it was specifically used for classification of "existing vegetation", not for land and site classification."*

(Editorial comment:--This has resulted in intense debates over the past two decades that cannot easily be resolved unless one accepts that each approach has totally different objectives, and that neither really replaces the need for the other. The challenge for vegetation scientists is clearly describe how they relate to each other! We are not there yet in most of our textbooks and much of our scientific literature because we spend too much time arguing with each others narrow paradigm's. However, the panel is close to providing enlightment with this manuscript! And the TNC has provided a great starting point by including all the published "late-successional" associations and alliances in their master list of existing vegetation which provides a great starting point for collecting data and defining the missing "mid-and early- successional associations" that are generally missing!)

4.1.1 Association , p. 26 -- line 5 -- please add Daubenmire 1952, 1968 to be fair and consistent with Chapter 2. Daubenmire clearly built his refined concept on the foundation of the 1910 definition!

P. 27, end of 4.1.1 section. Please add a sentence that is critical and belongs here, "T*he tabular methods help identify and display both dominant and diagnostic species and are an essential component of most published taxonomies of associations."*

That concludes my editorial suggestions -- few, but I think they are important.

CONCERNS: I am concerned about the future of the Panel and our ability to finish this part of the job. I wish David Glenn-Lewin could help shepherd this through the publication process. I think that we need a writer to incorporate the review comments that is not directly and intimately involved in defending any one perspective. I think that the review comments need to be shared with the entire panel in this cycle to maintain buy-in and seek consensus. I think a special two-day meeting might help accomplish that goal. Historically, the two-day work sessions were extremely effective, whereas the poorly attended sessions at national ESA meetings never addressed the critical detail of our report.

And, I miss the friendly, stimulating professional dialogue that we have shared and the opportunity to work with all the talent of the Panel members. It has been a great professional experience and I hope it will continue.

Appendix D (4 pages): Text from 8/8/99 ESA Poster Presentation as Draft Manuscript for distribution to members of ESA Vegetation Classification Standards Committee.

Linking Established Plant Associations to the National Vegetation Classification System: A Montana Test

Robert D. Pfister, School of Forestry, University of Montana, Missoula, MT

Abstract:
Thousands of late-successional plant associations have been published throughout the western United States during the past five decades. Development of a standardized national vegetation classification system raises questions on fitting old types to new standards. Two data sets from major studies in Montana were examined to determine syntaxonomic relationships with current proposed definitions and standards. Results illustrate that one should not assume that everything will fit. Recommendations for NVCS development are offered.

Background: The NVCS is a seven-level hierarchy proposed by the Vegetation Subcommittee of the Federal Government Data Committee (FGDC). The upper five levels are based on primarily physiognomic criteria; the lower two levels are based on floristics. The upper five levels and standards for application were approved by Secretary of the Interior, Bruce Babbitt in 1997. The two lower levels (Alliance and Association) were proposed with additional work to be done on developing the standards for application. In 1998, The Nature Conservancy published Volume I of the NVCS and Volume II (a list of Alliances and Associations). The Vegetation Panel of the Ecological Society of America has been reviewing work to date and preparing draft standards for defining new Associations and Alliances (July 1999 review draft).

Two existing databases provided an excellent opportunity to test whether existing local classifications could provide useful types for the NVCS. In 1997, a monograph was published for the forests of Montana based on 1,496 sample stands (Pfister and others 1997). This data base consisted of releve's from relatively undisturbed late-successional stands, grouped to define "Associations". A key was written to identify the sites where the associations would represent the latest projected successional stage (the habitat type). In 1985, a monograph was published defining successional stages of four major habitat types based on 770 sample stands (Arno, Keane & Simmerman 1985). A key was developed to identify these vegetation types. The plant community types were based on stands having similar floristics and were subdivided based on structural stages of secondary succession.

1977 Results-- A total of 60 associations (late successional) were defined, based on floristic similarity and diagnostic differential species. "Diagnostic" refers to those species having the most consistent pattern of occurrence relative to known or inferred gradients of habitat conditions. The 60 associations were grouped into 10 "Series" based on the indicated "climax" dominant tree species (most shade-tolerant species occurring in that environment). However, this precluded using the "dominant" tree of the stand as a criterion for classification. A table of the "Distribution and Dynamic Role of Tree Species by Habitat Types" (Appendix B) illustrates multiple possibilities for dominance of existing vegetation on a given site. In retrospect, using the indicated potential climax dominant tree species as a "diagnostic differential" allows one to either define "Series" first and then define "Associations within Series", or define Associations first and later group those sharing a specific diagnostic criteria into "Series".

1999 Results: Dominance variation within Associations: Detailed stand tables were available for 1,001 of the 1,496 stands that could be examined to determine how much variation of actual dominance was represented in the data base. Of the 1,001 stands, a total of 983 stands were within defined associations (**BOLD NAMES**). Table 2 illustrates that less than one-half (447 of 983) of the sample stands within a defined association were dominated by the diagnostic namesake tree species. The remaining 554 sample stands were dominated by a wide variety of of other dominant species. These results are in general agreement with Appendix B and suggest that earlier successional stages on the same environment (habitat type) could be dominated by a wide variety of different dominant tree species. This comes as no surprise to vegetation scientists that have been defining late-successional associations and their corollary site classification (habitat types). However, it raises several questions on how these established Associations might fit with proposed new standards for defining Alliances and Associations for "Existing Vegetation".

Table 1 - Distribution of Releve's by Late-successional Associations/ Dominance Types (from Pfister and others 1977)

Domin. Types: / C. Name / L.S. Association	S. Name / Total #	PIFL / LP	PIPO / PP	PSME / DF	PICO / LPP	LAOC / WL	PIEN / ES	ABGR / GF	PIMO / WP	THPL / WRC	TSHE / WH	ABLA / AF	TSME / MH	PIAL / WBP	LALY / AL	TOTAL / PB / # w/SI_T
Scree	16	2	4	5												11
PIFL/AGSP	6	5	1													6
PIFL/FEID	11	6		4												10
PIFL/JUCO	7	4														4
PIPO/AND			1													1
PIPO/AGSP	21		21													21
PIPO/FEID	30		29													29
PIPO/PUTR	11		9													9
PIPO/SYAL	11		10													10
PIPO/PRVI	6		8													8
PSME/AGSP	13		4	7												11
PSME/FEID	19			14												14
PSME/FESC	13		6	7												13
PSME/VACA	27		14	3	3	4										24
PSME/PHMA	53		4	39		1										44
PSME/VAGL	40		6	13	7											26
PSME/LIBO	30		2	16	5	4										27
PSME/SYAL	67		18	40	2											60
PSME/CARU	97		22	51	9											82
PSME/CAGE	10			10												10
PSME/SPBE	11		4	6												10
PSME/ARUV	8		5	2												7
PSME/JUCO	14			4	5											9
PSME/ARCO	13			11												11
PSME/SYOR	8			1												1
PICEA/EQAR	9						6									6
PICEA/CLUN	24				4	6	1									11
PICEA/PHMA	6			4												4
PICEA/GATR	15		1	2	1		9									13
PICEA/VACA	5				2											2
PICEA/SEST	10	1		2			5									8
PICEA/LIBO	21			6	13		1									20
PICEA/SMST	10		1	5	1		2									9
ABGR/XETE	6			1	1	2		1								5
ABGR/CLUN	16			3		2		6								11
ABGR/LIBO	8							3								3
THPL/CLUN	31			1	1	4		2		7						15
THPL/OPHO	11									1	1					2
TSHE/CLUN	38					2		1	5	1		1				10
ABLA/OPHO	4						2		1							3
ABLA/CLUN	103		1	10	6	21	13	2				4				58
ABLA/GATR	34			4	7	1	15					5				32
ABLA/VACA	10				7											7
ABLA/VACA	10				7											7
ABLA/CACA	35				6		11					1		1		19
ABLA/LIBO	50		1	9	17	1	4					2				34
ABLA/MEFE	64			3	14	2	10					12				41
TSME/MEFE	10											1	2			3
TSME/XETE	9				2								1			3
TSME/LUHI	4				1									1		2
ABLA/XETE	61			11	22	2	3		1			9		1		49
ABLA/VAGL	21			2	10		1					2		1		16
ABLA/VASC	37			1	23		3					2				29
ABLA/ALSI	6				3		1					1				5
ABLA/CARU	8			1	3		1									5
ABLA/CLPS	15	2		5			1					1		1		10
ABLA/ARCO	24			9			1					3				13
ABLA/CAGE	9			3	2							1				6
ABLA/RIMO	6						3					1		1		5
ABLA/LUHI	53				5		7					17		9		38
ABLA-PIAL/VASC	44				3		4					1		14		22
PIAL-ABLA h.t.s	30						2					6		9		17
PIAL h.t.s	9													5		5
LALY-ABLA h.t.s	36															0
PICO/PUTR	3				3											3
Totals	1437	20	172	315	188	52	106	15	7	9	1	70	3	43	0	1001

(HT./ CT. MT 6-99 - Dominance based on plurality of basal area from 1,001 stands with detailed tree data)

Implications for NVCS consideration: The Nature Conservancy has already included the 60 Associations in Table 1 and listed them under the Alliance name that matches "Series". This provides **10 Alliances and 60 Associations.** That technically includes the stands within the bold boxes (447), but not the stands outside the boxes (554). If the Alliance of the NVCS is to be based primarily on dominance, then the above data base could be reanalyzed to define **15 Alliances and 167 Associations** of "Existing Vegetation" types. Additional Alliances could also be defined by adding a diagnostic differential tree species to the dominant species similar to current practice in parts of the eastern U.S. For example, following that protocol would subdivide the widespread PIPO (*Pinus ponderosa*) dominance type into the following Alliances: PIPO-PIFL, PIPO-PIPO, PIPO-PSME, PIPO-PICEA, and PIPO-ABLA. Considering all possibilities in Table 1, this approach could justify defining a total of **39 Alliances** from this database alone and several additional alliances when early successional stands are added to the database.

1985 Results: The highest level of the classification hierarchy is the structural stage of succession: shrub-herb, sapling, pole, mature seral forest, and old-growth forest. Community types are designated based on the composition of the undergrowth and overstory species. Four major habitat types (seven units at the h.t. phase level) in western Montana were sampled with a "paired-plot" sampling scheme. Each classification was illustrated like Figure 6 where 10 unique floristic plant community types are named. Combining the floristic community types and the structural stages reveals 16 unique vegetation types (stand types). The study defined 79 unique plant community types (floristics) and 113 stand types (floristics + structural stage).

Table 2 - Numbers of Vegetation Successional Types W. MT (from Arno and others 1985)

Habitat type, Phase	# Stands (Releve's)	Arno Comm. Types (Floristics)	Arno Stand Types (Floris. + structure)	NVCS PHYS. TYPES	NVCS PHYS = Comm Type	NVCS PHYS = Stand Type
PSME/PHMA h.t., dry phase	146	9	17	4	1 of 9	1 of 17
PSME/PHMA h.t., moist phase	79	10	16	4	1 of 10	1 of 16
PSME/VAGL h.t., XETE phase	121	11	13	9	5 of 11	5 of 13
ABLA/XETE h.t., VAGL phase	125	10	13	8	4 of 10	4 of 13
ABLA/XETE h.t., VASC phase	77	10	15	7	4 of 10	4 of 15
ABLA/MEFE h.t., warm phase	124	16	22	7	1 of 16	1 of 22
ABLA/MEFE h.t., cold phase	79	13	17	9	1 of 13	1 of 17
Totals		79	113			

Implications for NVCS consideration:
Each of the seven habitat type phase units were examined for relationships with the NVCS and summarized in the right half of Table 2. I assume that the 79 floristic community types may qualify as NVCS "Associations". Figure 6 includes four different physiognomic types. Some of the units had a many as 9 different physiognomic types represented. Regarding nesting within Physiognomic Types, very few of the community types stayed within the criteria. Even at the finest level of detail (Stand Type) very few units stayed within the physiognomic type criteria. A "crosswalk" between these detailed and well accepted plant community types and NVCS physiognomic types would be a very treacherous bridge! On the other hand, it would be easy to place physiognomic type labels on the individual stands included within a type!

Discussion: -- The re-analysis of the Montana forest habitat type data base reveals that all stands within a late successional Association may not meet proposed NVCS criteria. Should all the data be reanalyzed to redefine all associations? Or, which of the published Associations can be "grandfathered" into the NVCS? Furthermore, the keys that are published with late-successional association monographs are keys to potential natural vegetation (habitat type), not to the existing Association or Alliance of the NVCS.

The Arno and others (1985) publication represents an example of how many different community types can be found within a limited environmental range if one samples a full variety of successional variants. In recognition of the "cone" or "pyramid" models of secondary succession, we predict that one could recognize 10 to 20 different community types leading toward a single "late-succesional" Association. Sampling and defining all these community types would provide the ultimate foundation for understanding the variation of vegetation with the variables of Space, Time, and Disturbance. However, until that data base is obtained, practical approaches are needed to meet the wide variety of disciplinary needs for an operational NVCS.

Concluding Statement:

1. The NVCS is a noble goal deserving the full support of vegetation scientists in the ESA.
2. Progress toward that goal by the Vegetation Subcommittee of the Federal Government Data Committee (FGDC) represents a major step forward in addressing a legacy of confusion and contradiction among various facets of vegetation inventory, taxonomy, and mapping.
3. Decades of effort by The Nature Conservancy represent the only concerted, formal effort to establish a standard NVCS for the United States. Publication of Volume I and Volume II of the NVCS provides an excellent benchmark for moving toward an operational NVCS.
4. Standards are a logical next step to address the variability in interpretation of any glossary. Definitions of terms are a starting point for achieving communication. However, definitions alone do not ensure standardization. Examination of existing databases and taxonomies reveals as many questions as answers.
5.. The NVCS has potential to provide a taxonomy (syntaxonomy) that will allow millions of users to identify standard vegetation types. Beyond a list of types, this will require a key, or an unambiguous rule set for users to identify standard established types.
6. Once standards for taxonomy are established, standards for map unit definition can follow.

Recommendations for NVCS:

1. Provide a place for "Dominance Types" in the NVCS since they are currently standard operational vegetation classification variables in inventory, remote sensing, and a variety of mapping protocols.
2. Clarify the relationship of dominant species to diagnostic (differential and character) species for the process of defining new associations or evaluating integrity of previously defined Associations.
3. Clarify relationship between Alliances and Associations. Can Alliances be defined before all the Associations are defined? Can there be more than one recommended grouping of Associations to form Alliances (e.g. Groups of Associations with a shared Dominant species Vs. Groups of Associations with a shared major Diagnostic species)?
4. Disconnect the "nested" hierarchy! Identify Physiognomic Types, Alliances, and Associations by independent taxonomic methods. Relational databases provide the opportunity for flexibility in classification protocols. One can assemble unique hierarchies for a variety of interpretations.
5. Grab this golden opportunity to provide an objective, technically sound, foundation to guide the efforts of vegetation scientists in the next millennium.